Remarks/Arguments

Claim Rejections – 35 U.S.C. § 103

Claims 17-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fisher *et al.* (U.S. Patent 6,307,852), in view of Takatori *et al.* (US 5,475,676).

Claim 17 is the sole independent claim of this application. Claim 17 requires "a plurality of switch modules" "wherein each of said switch modules is communicatively connected through a dual channel to each clockwise rotator and to each counterclockwise rotator and wherein at least two of said clockwise rotators have different reference phases and at least two of said counterclockwise rotators have different reference phases".

Applicant submits that Fisher discloses a uniphase rotator switch, while the present application discloses a polyphase circulating switch. In column 10:20-22, Fisher states clearly: "At any time the source is connected to the **same tandem phase** in the rotation cycle of **either rotator** (130 or 132)." This will be described in further detail below.

Takatori discloses a switch for a self-healing network using a conventional bidirectional ring.

Uniphase *versus* Polyphase Switching

Fisher describes a switch comprising parallel rotator planes 130, 132, operating in phase so that data units sent from a given source node from among the plurality of source nodes {10, 12, ..., 24} to a given destination node from among the destination nodes {46, 48, ..., 60) experience the same delay whether transferred through rotator plane 130 or rotator plane 132. This is greatly facilitated by constructing identical rotator planes operating in phase to realize uniphase switching. The independence of source-destination transfer delay of the rotator plane used is necessary because an

information unit (IU) in Fisher may be split among the two rotator planes, as stated in column 10:16-20 recited below. If the two parts of the same IU (same packet) experience different transfer delays, reassembling the split packet would require adding more fields in the packet header which unnecessarily complicates the switch. Fisher addressed this issue by providing uniphase switching as explained in column 10:16-20:

> "In operation, Source 0 is now able to send either (i) an IU to each of two rotators at half the rate of FIG. 4 or alternatively (ii) to send the first half of the IU to one rotator plane (130) and the second half to the second rotator plane (132). At any time the source is connected to the **same tandem phase** in the rotation cycle of either rotator (130 or 132)."

In contrast, the polyphase circulating switch of the instant application is characterized by the use of **multiple rotators (not rotator planes) of different reference phases**. In the polyphase circulating switch, a packet need not be split. Thus, the polyphase circulating switch is distinct from the uniphase rotator switch because of (1) the use of simple rotators instead of multi-stage rotator planes and (2) the differing reference phases of the rotators.

The reference phase of a rotator is defined in paragraph [0360] of publication 2004/0184448 of the present application:

"[0360] In the arrangement of FIG. 51B, each rotator in the first group has the same phase reference where, at the start of a rotation cycle, each rotator input port 0 connects to respective output port 0. The reference phases of rotators 5120B-1, 5120D-1, 5120F-1, and 5120H-1 of the second group are 0, 2, 4, and 6, respectively, the reference phase of a rotator being defined by the output port to which input port 0 is connected at the start of a rotation cycle." (*emphasis added*)

A rotator is defined in the specification of the present application as a passive device which cyclically establishes one-to-one connections between a plurality of inlets and a plurality of outlets. This definition is also applicable to any of the commutators 26,

44, 62, 72, 80, 82, 84, 86, 90, 92, 94, 96, 120, 122, 124, or 126 illustrated in Figures 1 to 5 in Fisher.

A rotator cyclically connects each of a plurality of inlets to each of a plurality of outlets during a rotation cycle. A rotation cycle is defined in the specification of the present application as "a period of time during which a rotator completes a predetermined inlet-outlet connectivity pattern. A rotation cycle includes an integer number of rotation phases". A rotation phase is a period of time during which a rotator maintains particular inlet-outlet connectivity. A time slot is the duration of a rotation phase. (Please see paragraphs [0108], [0123], [0124], and [0125] of publication 2004/0184448.)

A circulating switch using rotators of different reference phases is illustrated in FIG. 50 and FIG. 51 of the present application. FIG. 50 (which is reproduced herein for the convenience of the Examiner) illustrates a circulating switch having eight switch modules 5022-0 to 5022-7 interconnected by rotators (commutators) 5020A, 5020B, 5020C, and 5020D. Rotators 5020A and 5020C are clockwise rotators. Rotators 5020B and 5020D are counterclockwise rotators. Please see paragraph [0352] of publication 2004/0184448 of the present application.

Each rotator has eight dual ports labeled as dual ports 0 to 7. A dual port of a rotator comprises an inlet port and an outlet port as described in paragraph [0146] of publication 2004/0184448. Thus each rotator has inlets labeled as 0 to 7 and outlets labeled as 0 to 7.

During a first time slot of a rotation cycle:

Inlet port 0 connects to outlet port **0** within rotator 5020A.

Inlet port 0 connects to outlet port **0** within rotator 5020B.

Inlet port 0 connects to outlet port **4** within rotator 5020C.

Inlet port 0 connects to outlet port **4** within rotator 5020D.

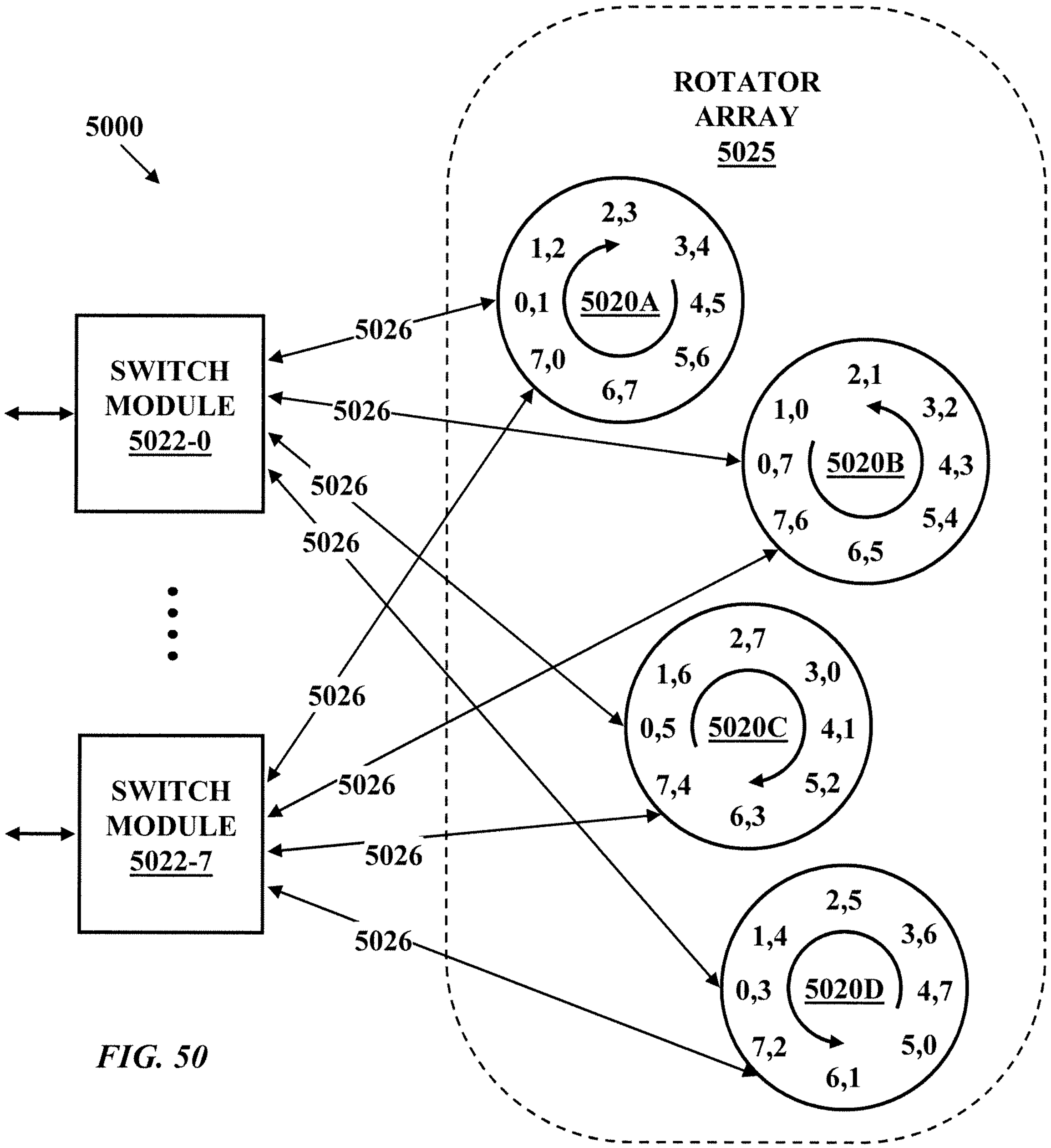
5000
ROTATOR
ARRAY
5025
SWITCH
MODULE
5022-0
SWITCH
MODULE
5022-7
5026
5020A
2,3
1,2
3,4
0,1
4,5
7,0
5,6
6,7
5020B
2,1
1,0
3,2
0,7
4,3
7,6
5,4
6,5
5020C
2,7
1,6
3,0
0,5
4,1
7,4
5,2
6,3
5020D
2,5
1,4
3,6
0,3
4,7
7,2
5,0
6,1

FIG. 50

During a second time slot of a rotation cycle:

inlet port 0 of clockwise rotator 5020A connects to outlet port **1** of the same rotator;

inlet port 0 of clockwise rotator 5020C connects to outlet port **5** of the same rotator;

inlet port 0 of counterclockwise rotator 5020B connects to outlet port **7** of the same rotator; and

inlet port 0 of counterclockwise rotator 5020D connects to outlet port **3** of the same rotator.

Switch module 5022-0 has four dual channels 5026 to a dual port of label 0 in each of the four rotators (a dual port comprising an inlet and an outlet of a rotator). If, at the start of a rotation cycle, switch module 5022-0 has a data segment to deliver to switch module 5022-7, for example, a controller of switch module 5022-0 may select any of the four PASSIVE rotators. Rotator 5020-0 connects switch module 5022-0 to switch module 5022-7 during time slot 7 of each rotation cycle. Thus, if clockwise rotator 5020-A is selected, the data segment has to wait in switch module 5022-0 for seven time slots. If counterclockwise rotator 5020-B is selected, the data segment has to wait in switch module 5022-0 for one time slot. If clockwise rotator 5020-C is selected, the data segment has to wait in switch module 5022-0 for three time slots. If counterclockwise rotator 5020-D is selected, the data segment has to wait in switch module 5022-0 for five time slots. Thus, there are four paths from switch module 5022-0 to switch module 5022-7 requiring waiting at switch module 5022-0 for time periods of seven, one, three, and five time slots. The controller of switch module 5022-0 may then select rotator 5022-B which requires the least waiting time. If switch module 5022-0 has a data segment destined to switch module 5022-2, for example, then the waiting time at

switch module 5022-0 would be two time slots if rotator 5020A is selected, six time slots if rotator 5020B is selected, six time slots if rotator 5020C is selected, and two time slots if rotator 5020D is selected. In this case, the controller of switch module 5022-0 may select rotator 5020A.

A data segment may be transferred from switch module 5022-j to switch module 5022-k indirectly through an intermediate switch module 5022-m, where $j \neq k \neq m$. The data segment then encounters a switching delay at switch module 5022-m. The switching delay at switch module 5022-m depends on the rotator (5020A, 5020B, 5020C, or 5020D) used to transfer the data segment from switch module 5022-j to switch module 5022-m, and the rotator (5020A, 5020B, 5020C, or 5020D) used to transfer the data segment from switch module 5022-m to switch module 5022-k. Thus, the use of rotators of different reference phases provides an opportunity to select rotators, according to the indices j and k, which result in minimum switching delay. Please see FIG. 67 of the present application.

The flexibility realized by using rotators of different reference phases enables construction of very large scale switches, comprising more than 8000 switch modules for example. This capability is not disclosed anywhere in the prior art.

The Examiner asserts that a rotator plane 130 of Fisher has its own reference phase. The Examiner refers to the passage in column 6:39-45 which describes the prior-art rotating access switch of US 5,168,492. The passage explains that a data unit transferred from a source node to a destination node through any intermediate node of a rotating access switch is held in the intermediate node for a period of time that is specific to the source-destination node pair. This is an inherent property of the rotating access switch. Therefore, the passage does not support the Examiner's assertion.

The Examiner equates a rotator plane 132 of FIG. 5 in Fisher with a counterclockwise rotator in the polyphase circulating switch of claim 17.

The Examiner further asserts that rotator plane 132 has its own reference phase. The Examiner cites the passage in column 6:39-45 which explains that the amount of delay within a rotating access switch is specific to a source-destination node pair. As described earlier, rotator plane 132 is identical to rotator plane 130 so that, for a given source-destination node pair, the inherent delay within rotator plane 132 is EXACTLY EQUAL to the inherent delay within rotator plane 130 in order to allow splitting an information unit (IU) into two parts propagating in unison through the two rotator planes 130 and 132.

Clearly, the uniphase rotator switch of FIG. 5 in Fisher is distinct from the polyphase circulating switch of the present application and this results in different operations. For example, the rotator planes 130, 132 of Fisher's uniphase rotator switch have the same inherent delay for a specific source-destination node while the rotators 5020 of the subject polyphase circulating switch connect a switch module 5022 to another switch module 5022 during different time slots within a rotation cycle, thus the delay from an originating switch module to a destination switch module depends on the rotator 5020 selected for transferring a data unit.

For all of the foregoing reasons, it is respectfully requested that the rejection of claim 17 be withdrawn. Since the remaining claims depend, directly or indirectly from claim 17, it is also submitted that the rejection of these claims should be withdrawn.

Conclusion

Claims 17-25 are pending. Claims 1-16 are cancelled and claims 26-39 are withdrawn from consideration. Claim 17 has been amended. Claims 22-25 have been amended to improve clarity.

In view of the foregoing, early favorable consideration of the application is earnestly solicited.

Respectfully submitted,

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